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QUANTITATIVE AND QUALITATIVE ANALYSES OF EXOGENOUS AND ENDOGENOUS CHILDREN IN SOME READING PROCESSES.

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DESCRIPTORS- *READING PROCESSES, *RETARDED CHILDREN, *MENTAL RETARDATION, *CURRICULUM PLANNING, READING TESTS, SYRACUSE, NEW YORK, SYRACUSE VISUAL FIGURE BACKGROUND TEST, STANFORD BINET TEST, RIGGS AND RAIN CLASSIFICATION SYSTEM

THE PURPOSE OF THE PRESENT STUDY WAS TO INVESTIGATE THESE ASPECTS OF THE READING PROCESS--(1) SILENT AND ORAL READING ACHIEVEMENT, (2) PATTERN OF READING ERRORS, (3) AND AUDITORY AND VISUAL PERCEPTION TECHNIQUES. THE FACT THAT COMPARISONS BETWEEN THE EXOGENOUS AND ENDOGENOUS GROUPS ON THE QUANTITATIVE AND MOST OF THE QUALITATIVE ASPECTS OF TEST PERFORMANCE DID NOT APPEAR STATISTICALLY SIGNIFICANT TENDS TO INDICATE THAT THE DEGREE OF GENERAL DISTURBANCES OF BEHAVIOR OF THE EXOGENOUS GROUP IS NOT SUFFICIENT AT THIS TIME TO INTERFERE WITH THE ACQUISITION OF READING SKILLS OVER AND ABOVE THE DIFFICULTIES ENCOUNTERED BY THE ENDOGENOUS GROUP. (JL)

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AND REHABILITATION

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CHAPTER I

STATEMENT OF THE PROBLEM

Introduction

Special techniques established for the training and education of mentally handicapped brain injured children are geared specifically to the alleviation or control of psychological behaviors accompanying neurological defects rather than to any known educational disabilities characteristic of brain injured children. Numerous studies have been designed to isolate distinguishing psychological characteristics of brain injured and non-brain injured groups but there is a dearth of literature concerned with the impact of brain damage upon school achievement. A recent review of the literature (27) lists only three studies dealing with differential achievement in academic subjects (7, 10, 18), and these are limited to the area of arithmetic.

This study was undertaken to provide further information regarding the quantitative and qualitative behavior of exogenous and endogenous mentally handicapped subjects on some aspects of the reading process. It was felt that an analysis of the results would help in the future for the evaluation of particular areas of weakness in either or both groups of retarded youngsters and would also be of indeterminable help in the proposal of specific remedial and/or teaching methods for the brain injured.

Definition of Terms

For the purpose of this investigation the following definitions of terms were employed:

Exogenous mentally handicapped group of subjects (subsequently referred to as the exogenous group). This group was defined as being composed of those subjects:

1. whose case histories indicated evidence of brain injury according to the Riggs and Rain classification system and no evidence of mental retardation in the primary family group;
2. whose background responses to the Syracuse Visual Figure-Background Test numbered four or more;
3. whose intelligence quotients ranged within the limits of 50 to 85 as measured on the 1937 revision of the Stanford-Binet Tests of Intelligence, Form L.

Endogenous mentally handicapped group of subjects (hereafter referred to as the endogenous group). The endogenous group was defined as being composed of those subjects:

1. whose case histories contained evidence of mental retardation in the immediate family and no evidence of brain injury as listed in the Riggs and Rain classification system;
2. whose responses on the Syracuse Visual Figure-Background Test contained no references to background;
3. whose intelligence quotients ranged within the limits of 50 to 85 as measured on the 1937 revision of the Stanford-Binet Tests of Intelligence, Form L.

Some aspects of the reading process

These aspects were operationally defined as performance on tests which purported to measure the following:

1. silent reading achievement,
2. oral reading achievement,
3. pattern of reading errors,
4. auditory techniques,
5. visual perception techniques.

Review of the Literature

The literature most relevant to this problem can be organized into comparisons of exogenous and endogenous retarded subjects on psychological and educational tests and comparisons of the reading performance of mentally retarded with mentally normal or superior children.

Studies Comparing Performance of Exogenous and Endogenous Subjects on Psychological and Educational Tests

Comprehensive reviews of the literature pertinent to the study were prepared recently by Gallagher (27) and Capobianco (18).

Summarizing the research findings dealing with perception, Gallagher comments:

> In the over-all area of perception some generalizations from the research can be made. Although the visual perception of the brain-injured children was quite adversely affected by introducing distracting stimuli, there exists enough evidence to suggest that their poor performance as a group must also be attributed to a defect in the central process itself. These are two factors which need to be considered separately. It is conceivable that the child's perceptual abilities, as measured in the perceptual organization studies, could be markedly improved by merely removing, or developing a tolerance for, distracting stimuli. Under these circumstances it is well to reflect on the possibility that

> poor performance of brain-injured children on these perceptual tasks may be due as much to poor attention as to inadequate central perceptual skills. Neither the auditory or kinesthetic perceptual areas have been investigated sufficiently to comment on any differences (27, p. 19).

For the areas of intellectual scatter and conceptual development Gallagher's review points out the inconsistencies in results reported by previous investigators. He states further that the lack of attention span in brain injured subjects rather than any perception or organization deficit is perhaps responsible for poor performance in certain tasks. Summing up his review of research dealing with arithmetic skills Gallagher states:

> To sum up these findings, it would seem that there was little evidence in the above studies to support the initial and rational hypothesis that brain-injured children as a group should be doing more poorly in arithmetic than non-brain-injured children of the same mental level. It is conceivable therefore that the brain-injured children can learn quantitative concepts despite perceptual deficiencies (27, pp. 23-24).

Commenting on behavior and personality characteristics Gallagher remarks:

> The question of whether behavioral differences exist between the two etiological groups still remains unanswered. Due to methodological problems and uncertainty of diagnosis, the above studies can but give a few clues to the possible direction of differences. The essential question is not whether a few brain-injured cases are hyperactive or immature, as this can be easily demonstrated with individual cases, but rather whether these deviant characteristics are present in the majority of brain-injured children (27, p. 26).

A second major review of the literature by Capobianco (18) concentrates on research concerning psychological variations between exogenous and endogenous subjects. Summarizing his review he concludes:

> A careful search for generalizations concerning the psychological differences between brain injured and non-brain-injured cases reveals a state of confusion. In attempting to find justification for the conclusions drawn

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PROBLEM

omit ~~To investigate~~ This investigation studied some of the qualitative and quantitative differences between endogenous and exogenous children in certain reading processes.

MAJOR OBJECTIVES were:

1. To determine the diagnostic differences between endogenous and exogenous children;

2. To compare the reading achievement of endogenous and exogenous children with normal children of equivalent mental age levels according to nationally established norms; and

3. To offer suggestions concerning a reading curriculum or separate curricula for endogenous and exogenous children.

PROCEDURES AND DESIGN

Omit ~~The Riggs and Rain classification system with some modifications will be used~~ was used to select thirty endogenous children and thirty exogenous children in special classes in school systems. The information for the diagnosis ~~will be~~ was drawn from case histories and medical data. The exogenous group ~~will be~~ was further restricted to children who show perceptual psychopathology as determined by a recently devised histoscopic test which has been considered satisfactory in work with brain injured children. The endogenous and exogenous groups ~~will be~~ were matched on chronological age, mental age, educational background and sex. Differences between the two groups ~~will be~~ were then determined by an elaborate battery of tests, with especial emphasis on diagnostic reading instruments. An analysis of variance ~~will be~~ was used to determine differences.

> by one author, one is struck by the opposing conclusions and contradictory results presented by other investigators utilizing similar subjects. It appears that the modal personality sketch of the brain-injured individual does not exist. If the development of such a personality sketch is ever attempted, the methodology utilized in experimentation must be changed radically. Few, if any, of the preceding studies are presented in a form which would facilitate replication by other investigators. Perhaps, the apparent discrepancies in results among investigators are due to the measurements of various populations of brain injured cases and not to inadequacies of instruments used for measurement nor to the investigator. To establish behavioral attributes characteristic of the brain injured, careful experimentation must be conducted using adequate operational definitions of the variables and adequate controls. This would insure possible replication of similar studies on other samples of the brain injured population (18, p. 108).

Analyzing the results of a battery of arithmetic tests administered to 29 exogenous and 35 endogenous subjects Capobianco states:

> The absence of statistically significant differences between the endogenous and exogenous groups . . . strongly suggests that the exogenous subjects need not be confined to unique teaching methods in order to achieve up to their mental age in arithmetic. There is no reason to assume that the teaching methods at the state school . . . catered to the exogenous pupil, yet the exogenous group consistently worked more closely to capacity than did the endogenous subjects.
>
> Regarding the qualitative aspects of rigidity, reversals, and concept of zero, . . . a serious look into the theoretical psychological testing criteria for etiological classification is to be considered; for there were no statistically significant differences found between . . . groups on any of these behaviors . . . mental age . . . appears to be more important than etiology in respect to these qualitative functions (18, p. 135).

Gallagher (27) compared the perceptual ability, language development, concept formation, quantitative conceptualization, learning aptitude, personality and behavior of matched groups of 24 exogenous subjects and 24 endogenous subjects. The diagnosis for initial inclusion in either of the groups was ascertained with the Riggs and Rain classification system. Neurological examinations and electroencephalographic findings provided some further evidence

regarding the presence or absence of organic brain damage in the exogenous group.

> One of the most striking results of this study is the failure to find significant differences between the BI and F groups on any of the measures of perceptual ability. It is only when due notice is taken of the unusual distribution of cases on some of these variables that the expected and predicted trend is revealed (27, p. 41).

Gallagher concludes that the results of his and other studies indicate recognizable differences between the exogenous and endogenous groups. However, he points out that not enough evidence is present to warrant a differential program of education for all exogenous children.

Satter (52) compared the scatter scores on the Stanford-Binet, the Vineland Social Maturity Scale, the Chicago Test of Primary Mental Abilities and the California Achievement Tests on a group of normal children and three groups of mentally retarded children. The mentally retarded subjects were assigned classification according to the Riggs and Rain classification system.

An inspection of differences among mean scatter scores for the four groups showed the mentally retarded groups to have more scatter than the normal group (except for the endogenous group) on the Chicago Test of Primary Mental Abilities. There were no significant differences between the mean scatter scores of the endogenous and exogenous groups on any of the four tests. The exogenous children showed more scatter on the Binet than did the endogenous, but this difference was not significant.

Rosvold and others (51) studied the ability of exogenous and endogenous individuals on tasks requiring continuous attention. A new instrument designed for the study consisted of two series of letters mounted side by side on a revolving drum. On the first task the subject was asked to press a key every time he saw the letter X

through the viewer; the second task, to press the key when he saw an X preceded by the letter A. The results showed that the exogenous subjects performed less adequately than the endogenous subjects. The difference between the two groups on the X task was significant at less than the .01 level; for the AX task, less than the .005 level, showing that as the difficulty of the task increased, the difference between the groups increased. The authors feel that the Continuous Performance Test may be useful as a diagnostic instrument.

Studies Comparing Reading Achievement of Mentally Retarded with Mentally Normal or Superior Children

As part of his review of the literature, Dunn (24) reports in detail on nine studies comparing the reading processes of the mentally retarded with those of higher intellect. Most of the studies dealt with children in the regular grades, the majority of whom might be classified as dull normal.

Four of these studies show the retarded inferior in reading to mentally normal or superior children. Five studies report the retarded working up to, or above, their expectancy level.

Dunn concludes this section of his review with the following comment:

> Results of studies reviewed in this section revealed no sharp contrasts in findings. The review did indicate, however, the need for more precise experimental designs, and greater use of inferential statistics (24, p. 20).

In his own very comprehensive study Dunn compared the reading processes of a group of 20 mentally retarded white boys with 30 mentally normal white boys both ranging in mental age from 8 to 10 years. The mentally retarded group attended special classes in public schools. No differentiation was made between the exogenous and endogenous in the retarded group.

The aspects of the reading process considered were: silent and oral reading ability, pattern of reading errors, ability to use context clues, ability to blend sounds, eye-movements, and recognition of tachistoscopically presented phrases and words. In addition, these related factors of reading were studied: auditory acuity, visual efficiency, lateral preference, personal adjustment, home conditions, and school history.

The results of Dunn's study revealed that the normal group was superior to the retarded group on all the measures of silent and oral reading ability. The profile of the mean number of reading errors reveals significantly more faulty vowels, omission of sounds, and refusals and words aided for the retarded group but significantly fewer repetitions and additions of sounds. No significant differences were found between the two groups on omission of words, substitution of words, addition of sounds, reversals, and faulty consonants. The retarded group was inferior on the test of ability to use context clues. Examination of the results of tests of sound-blending ability, eye-movements, and recognition of tachistoscopically presented phrases and words revealed no significant differences.

Significantly more visual and auditory difficulties were found in the retarded group. A slight trend was found toward more left-handedness as well as mixed dominance in eyedness and handedness. Teachers rated the retarded group as more maladjusted and as having more inferior home backgrounds. The normal group averaged less than 3 years in school attendance compared to slightly more than 7½ years for the retarded.

Purpose of the Present Study

The preceding review of the literature has indicated a large number of studies comparing exogenous and endogenous subjects on psychological tests, but relatively few comparing the two populations on quantitative and qualitative aspects of educational achievement. The results of studies using psychological tests indicate inconsistency, not only in the results obtained but also in the methodology employed. The research using educational tests by Bensberg (10) and Capobianco (18) revealed no significant differences between the two groups on arithmetic skills.

The survey of the research revealed no study comparing exogenous and endogenous subjects in the reading processes. The most intensive study reviewed, which dealt with the reading of mentally handicapped subjects, was that of Dunn (24). However, he made no differentiation between the two etiological groups. Therefore, this present study is designed to investigate the reading processes of these two groups. The specific aspects studied are mentioned in the hypotheses stated below:

H_1: Exogenous mentally handicapped subjects do not differ significantly from endogenous mentally handicapped subjects in silent reading achievement.

H_2: Exogenous mentally handicapped subjects do not differ significantly from endogenous mentally handicapped subjects in oral reading achievement.

H_3: Exogenous mentally handicapped subjects do not differ significantly from endogenous mentally handicapped subjects in pattern of reading errors.

H_4: Exogenous mentally handicapped subjects do not differ significantly from endogenous mentally handicapped subjects in auditory techniques.

H_5: Exogenous mentally handicapped subjects do not differ significantly from endogenous mentally handicapped subjects in visual perception techniques.

CHAPTER II

PROCEDURE

Selection of the Subjects

The subjects selected for the present investigation were white males who met the following general criteria:

1. mental ages within the limits of 7 through 12 years, inclusive on Form L of the Stanford-Binet Intelligence Test, 1937 Revision;

2. revised Stanford-Binet intelligence quotients within the limits of 50 through 85 inclusive;

3. chronological ages less than 22 year 0 months;

4. absence of notation in institutional case files indicating the presence of severe auditory handicap, visual defect, or motor impairment of both upper extremities;

5. reading achievement of first grade level or above as noted on school records.

The specific criteria for selection of the exogenous and endogenous groups are as follows:

Exogenous Group

1. The diagnosis of exogeny for each subject was established through the Riggs and Rain (50) classification system. Only those subjects exhibiting characteristics listed as "definite" evidence of exogeny were considered.

2. No history of retardation in the subject's family was indicated in the institutional records.

3. Four or more background responses were made by the subject on the Syracuse Visual Figure-Background Test (23).

Endogenous Group

1. The Riggs and Rain classification system requirement of one parent and/or sibling diagnosed as mentally retarded was further restricted to those who had at least one mentally retarded parent according to institution records.

2. The case history of the subject did not indicate the presence of organic evidence as listed in the Riggs and Rain classification system.

3. The subject gave no background responses on the Syracuse Visual Figure-Background Test.

The retarded subjects were selected from the academic classes of the Newark State School, Newark, New York, and the Rome State School, Rome, New York. Neither institution offers any type of differential program for exogenous or endogenous patients.

As an additional means of identifying exogeny, the Syracuse Visual Figure-Background Test was administered individually to ascertain in the presence or absence of perceptual disturbance in figure-background relationships of the subjects. The test was first employed by Cruickshank, Bice, and Wallen (23) and is a variation of the test used by Strauss and Werner (71). This tachistoscopic method consists of the projection onto a screen of

a series of 16 slides picturing objects embedded in a structured background.

The screen was placed in a darkened room 82 inches from the lens so that the projected pictures fit within the limits of the screen. The subject was seated in a chair so that his head was in a position 1 foot in front and to the right of the projector. The 2 x 2 inch black and white slides were projected with a Spencer MG Delineascope equipped with a Kodak No. 2 Supermatic shutter set for .2 of a second. After each exposure the subject was asked to "tell me what you saw." The responses were recorded verbatim.

Two demonstration slides were projected to acquaint the subject with the task before the 16 test slides were shown. The first demonstration slide was a pictorial representation of a table with no structured background; the second, a car embedded in a structured background. No subject failed to identify the figure in the demonstration slides.

Each response was classified into one of these eight categories named by Cruickshank, Bice, and Wallen (23) in their scoring procedure.

1. Correct figure. The figure response originally intended was given.
2. Slightly incorrect figure. The figure response given was a close approximation of the intended one.
3. Correct figure with background. The figure response originally intended was given in addition to a reference to the background.
4. Slightly incorrect figure with background. The figure response given was a close approximation

of the intended in addition to a reference to the background.

5. Incorrect figure. The figure response given was incorrect.
6. Incorrect figure with background. The figure response given was incorrect in addition to a reference to the background.
7. Don't know. The subject was unable to give any response to the stimulus.
8. Background only. The response given was to background exclusively.

The frequency of the "background responses," limited to categories 3, 4, 6, and 8, above, is shown in Table 1. Those subjects in the originally identified exogenous group who gave four or more background responses became candidates for the exogenous group in this present study. The endogenous subjects who gave no background responses were considered for the endogenous group.

The Revised Stanford-Binet Tests, Form L, was administered to all subjects who had not been given this intelligence test within the previous nine months. Three of the exogenous group were eliminated from the study when their measured intelligence quotient failed to fall within the limits stated in the criterion. Twenty-nine remained in this group. From the 53 eligible endogenous subjects, 29 were selected to form a group that matched this foregoing group in terms of chronological age, mental age, and intelligence quotient.

TABLE

COMPARISON OF THE BACKGROUND RESPONSES OF THE EXOGENOUS AND ENDOGENOUS GROUPS FROM WHICH EXPERIMENTAL GROUPS WERE SCREENED

		Number of Background Responses																	
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
Exogenous Group (N = 66)	Number of Children making background responses	6	11	11	6	13	8	6	1		1				1	1		1	66
	Total number of background responses	0	11	22	18	52	40	36	7		9				13	14		16	238
Endogenous Group (N = 106)	Number of Children making background responses	53	25	13	13	2													106
	Total number of background responses	0	25	26	39	8													98

Comparison of Chronological Ages, Mental Ages, and Intelligence Quotients of the Exogenous and Endogenous Groups

Information given below regarding the chronological ages, mental ages, and intelligence quotients of the two groups is depicted in Table 2.

Chronological Age

The exogenous subjects had a mean chronological age of 15 years 4 months and the standard deviation was 2 years 7 months. The chronological ages of these subjects ranged from 11 years 7 months to 22 years 0 months. The mean chronological age of the endogenous subjects was 15 years 11 months with a standard deviation of 2 years 4 months. Their chronological ages ranged from 11 years 8 months to 21 years 9 months.

Mental Age

The mean mental age of the exogenous subjects was 9 years 1 month with a standard deviation of 1 year 2 months. The mental age range of these subjects was 7 years 8 months to 12 years 0 months. The endogenous subjects had a mean mental age of 9 years 1 month and a standard deviation of 1 year 2 months with a range of from 7 years 4 months to 11 years 6 months.

Intelligence Quotient

The mean Stanford-Binet intelligence quotient of the exogenous group was 64.93; the standard deviation, 8.64; and the range from 51 to 83. The intelligence quotients of the endogenous subjects were within the range of 50 to 78. The mean intelligence quotient was 63.27 with a standard deviation of 7.61.

TABLE 2

STATUS OF THE EXOGENOUS AND ENDOGENOUS GROUPS ON CHRONOLOGICAL AGE, MENTAL AGE, AND INTELLIGENCE QUOTIENT

Group	Chronological Age (Years-Months)			Mental Age (Years-Months)			Intelligence Quotient		
	$\bar{X}$	SD	Range	$\bar{X}$	SD	Range	$\bar{X}$	SD	Range
Exogenous	15-4	2-7	11-7 to 22	9-1	1-2	7-8 to 12	64.93	8.64	51 to 82
Endogenous	15-11	2-4	11-8 to 21-9	9-1	1-2	7-4 to 11-6	63.27	7.61	50 to 78

In matching the two groups for chronological age, mental age, and intelligence quotient the presence of the following conditions was required for each variable analyzed: the variances were homogeneous and the means were not significantly different. The Snedecore F-Test of homogeneity of variance and the t-test for uncorrelated means respectively were used in these analyses. The criterion for rejection of the null hypothesis was the .05 level of significance. Information from this comparison is contained in Table 3. The difference between the mean chronological ages of the subjects in both groups was 7.17 months. The t ratio of .91 was not significant at the .05 level. The F ratio of 1.25 between the chronological age variances indicated no significant difference. For the mental age variable the difference between means was .03 months. The t ratio was .01 which was not significant at the .05 level. The F ratio between mental age variances was 1.02 indicating no significant difference. The t ratio between the mean intelligence quotients of the two groups was .76 which was not significant at the .05 level. The F ratio of 1.29 between intelligence quotient variances indicated no significant difference.

Reading Tests

The reading tests were administered by the investigator individually with the exception of the reading section of the California Achievement Tests (62), which was administered to groups of four. The administration procedures given in the test manuals were rigidly followed. The testing rooms were reasonably quiet and free from interruption. The subjects were familiar with the tester. There was sufficient variety within the tests to hold the subjects' interest. No testing period lasted for more than

TABLE 3

COMPARISON OF CHRONOLOGICAL AGES, MENTAL AGES, AND INTELLIGENCE QUOTIENTS OF THE EXOGENOUS AND ENDOGENOUS GROUPS

Measure	Chronological Age[a]		Mental Age[a]		Intelligence Quotient	
	Exogenous	Endogenous	Exogenous	Endogenous	Exogenous	Endogenous
N	29	29	29	29	29	29
s^2	967.75	773.30	194.01	189.42	74.67	57.90
F	1.25		1.02		1.29	
$\bar{X}$	183.66	190.83	109.06	109.03	64.93	63.27
t	.91		.01		.76	

[a]Age in months.

one hour. Both the exogenous and endogenous groups were given two 5-minute rest periods during the hour. The reading battery was completed within a 5-week period for all subjects.

California Achievement Tests

The reading section of the primary battery was administered to all subjects. This was selected as a standardized group test which measures silent reading achievement and reveals the grade placement in relation to the general school population. Those subjects who attained a grade placement of 4.0 or higher were also given the reading section of the elementary battery (63) as Clark (22) recommends in situations where the range of achievement is sought. In these instances the higher of the two obtained scores was used as the grade placement in silent reading.

Gray Oral Reading Paragraphs Test

This test is composed of 12 paragraphs arranged in order of increasing difficulty. The pupil's oral reading grade is computed from the time required to read each paragraph and the number of errors made in each. The grade equivalents range from 1.0 to 8.0 grades.

Iota Word Test

This test measures the ability to read isolated words. The subject is requested to read aloud 53 words which are printed on cards. Grade norms based on the number of words correctly named range from 1.0 to 5.5 grades.

Monroe Word-Discrimination Test

This test consists of 47 columns of confusion words or arrangements of letters. The tester pronounces the key word located in each column to which the subject is asked to point. The number of words correctly discriminated is converted to grade norms ranging from 1.0 to 5.5 grades.

The qualitative aspects of the reading processes of the two groups were inspected by analysis of the errors from the three tests described above: Gray Oral Reading Paragraphs Test, the Iota Word Test, and the Monroe Word-Discrimination Test. This diagnostic examination purports to disclose tendencies for these types of reading errors:

1. faulty vowels,
2. faulty consonants,
3. reversals,
4. addition of sounds,
5. omission of sounds,
6. substitution of words,
7. repetition of words,
8. addition of words,
9. omission of words,
10. refusals and words aided.

Gates Auditory Techniques Tests

1. Blending Letter Sounds. Form II.

This test measures the ability to combine isolated sounds into words. The sounds comprising a given word were articulated by the examiner at the rate of one sound per second. The subject was

asked to name the word. A second trial was given if the subject failed the first time. The grade scores obtained are based on the number of correct responses for the twenty words and range from 1.6 to 4.4 grades.

2. Giving Words--Initial Sounds. Form I.

This test examines ability in the oral production of words which begin with the same sound. The subject was given a stimulus word and then asked to produce at least three other words which began with the same initial sound. Grade scores based on the number of correct responses to the six stimulus words ranged from 1.3 to 3.0 grades.

3. Giving Words--Final Sounds. Form I.

The purpose of this test is to determine the ability to furnish words, the endings of which rhyme with the endings of stimulus words. The grade scores for each subject were obtained by totaling the correct responses. The grade norms range from 1.3 to 3.3 grades.

Gates Visual Perception Techniques--Reading Capital and Lower Case Letters

This test is intended to ascertain the subject's ability to name letters. The capital and lower case sets of letters of the alphabet were printed on two separate cards. The grade scores obtained were the number correct and the time in seconds required to read each set. The grade norms for errors range from 1.5 to 2.5 grades; for speed, 1.5 to 4.0 grades.

Auditory and Visual Tests

Keystone Visual Survey Tests

The Keystone Visual Survey Test was used to compare the visual efficiency of the two groups. The testing purports to identify individuals who are nearsighted, farsighted, or have astigmatism; and also measures vertical imbalance, lateral imbalance, far-point fusion, and stereopsis level. The test appraises eye coordination under conditions considered similar to those found in reading. It consists of a series of sterescope cards which are placed in the Keystone Visual Survey Instrument also know as the telebinocular.

Audiometric Examination

A pure-tone audiometric test was administered. The frequencies were presented in the following order: 1,000, 2,000, and 500 at a sensation level of 20 decibels in the right ear, and then the left ear. If the subject did not respond to the tone at 20 decibels, the sensation level was increased in steps of 5 decibels until a response was obtained.

Plan for Analysis of the Results

The statistical techniques applied to the data were the t-test for uncorrelated means and the Snedecor F-test of homogeneity of variance as described by Edwards (25). The .05 level of probability was chosen as the criterion for rejection of the null hypothesis for all comparisons.

When the ratio obtained by the Snedecor F-test was

associated with the .01 level of probability or less, it was concluded that the groups differed markedly in terms of homogeneity of variance. When the groups showed such heterogeneity of variance, the table of t was entered with one-half the usual number of degrees of freedom in order to determine the t ratio between two means.

CHAPTER III

RESULTS

Comparison of the Exogenous and Endogenous Groups on Some Aspects of the Reading Process

Comparison of Silent Reading Achievement

Table 4 shows a comparison of the results obtained on the two measures of silent reading ability. On the reading section of

TABLE 4

DIFFERENCES IN READING GRADE BETWEEN GROUPS ON SILENT READING ACHIEVEMENT

Measure	California Achievement Test		Monroe Word Discrimination	
	Exogenous	Endogenous	Exogenous	Endogenous
N	29	29	29	29
s^2	2.50	1.09	1.89	1.38
F	2.29*		1.37	
$\bar{X}$	3.91	3.56	3.16	3.06
t	.980		.292	
Range	1.9 - 6.8	1.6 - 5.5	1.0 - 5.5	1.0 - 5.5

*Significant at less than the .05 level

the California Achievement Tests the exogenous and endogenous groups ranged in reading grade from 1.9 to 6.8 grades and 1.6 to 5.5 grades respectively. The variance for the exogenous group was 2.50 grades; the endogenous group, 1.09 grades. The F ratio of 2.29 between these two variances fell between the .01 and .05 levels of significance. The exogenous group obtained a mean silent reading

grade score of 3.91 grades compared to 3.56 grades for the endogenous group. Analysis of the difference between these two means yields a t ratio of .980 which is associated with a probability value larger than the .05 level.

The second test used which purports to measure an aspect of silent reading ability was the Monroe Word-Discrimination Test. Both groups scored over the entire range of reading grades (1.0 to 5.5) for this test. The variance for the exogenous group was 1.89 grades; the endogenous group, 1.38 grades. The F ratio of 1.37 was not significant. The mean scores of 3.16 grades for the exogenous group and 3.06 grades for the endogenous group resulted in a non-significant t ratio of .292.

In both tests of silent reading ability the non-significant values of t noted above afford evidence for failure to reject the hypothesis that the population means are equal. The analyses suggest that the observed differences may be regarded as chance ones.

Comparison of Oral Reading Achievement

Information about oral reading achievement of the groups is contained in Table 5. The range of reading grades on the Gray Oral Reading Paragraphs Test was 1.0 to 8.0 grades for the exogenous group; 1.0 to 5.4 grades for the endogenous. Inspection of the grade scores for each individual revealed that 8 of the exogenous subjects and 9 of the endogenous subjects received a minimum grade placement of 1.0 on this test. The F value of 2.52 between the exogenous group variance of 4.82 and the endogenous group variance of 1.91 has a probability of less than .01. Therefore, it was necessary to reject the hypothesis that the population variances are equal. The mean reading grade scores for the exogenous and

TABLE 5

DIFFERENCES IN READING GRADE BETWEEN GROUPS ON ORAL READING ACHIEVEMENT

Measure	Gray Oral Reading Paragraphs		Iota Word Recognition	
	Exogenous	Endogenous	Exogenous	Endogenous
N	29	29	29	29
s^2	4.82	1.91	2.52	1.44
F	2.52**		1.75	
$\bar{x}$	3.21	2.57	2.82	2.66
t	1.302[a]		.438	
Range	1.0 - 8.0	1.0 - 5.4	1.1 - 5.5	1.1 - 5.5

**Significant at less than the .01 level

[a]The t table was entered with one-half the number of degrees of freedom.

endogenous groups were 3.21 grades and 2.56 grades, respectively. The t ratio for this comparison was 1.302 and as such was not significant.

On the other measure of oral reading achievement, the Iota Word Recognition Test, a range of 1.1 to 5.5 grades was attained by both groups. The variance for the exogenous group was 2.52 grades; the endogenous group, 1.44 grades. The F ratio for this comparison was 1.75 and the probability greater than .05. The t ratio of .438, based on a mean score of 2.82 for the exogenous group and 2.66 for the endogenous group, fell above the .05 level of probability.

In the comparisons of the groups on two measures of oral reading ability the obtained t values are greater than a P level of .05. Accordingly, the hypotheses that the population means are equal cannot be rejected.

Comparison of Average Reading Achievement

In addition to providing a description of over-all reading achievement the average reading grade scores were used in the comparison of the two groups on patterns of reading errors presented in the following section of this chapter. These scores were determined by averaging the grade scores on the following four tests: California Achievement Tests, total reading score; Monroe Word-Discrimination Test; Gray Oral Reading Paragraphs Test; and Iota Word Recognition Test. It can be seen in Table 6 that the range of

TABLE 6

DIFFERENCES BETWEEN GROUPS ON AVERAGE READING GRADE

Measure	Group	
	Exogenous	Endogenous
N	29	29
s^2	2.54	1.28
F	1.98*	
$\bar{X}$	3.27	2.96
t	.849	
Range	1.30 - 6.45	1.35 - 5.42

*Significant at less than the .05 level

average reading grades for the exogenous group was 1.30 to 6.45 grades; the endogenous group, 1.35 to 5.42 grades. A variance of 2.54 for the exogenous group and 1.28 for the endogenous group was obtained. An F ratio of 1.98 between the variances was significant at less than the .05 but greater than the .01 level of probability. The mean average reading grade was 3.27 grades for the exogenous group and 2.96 grades for the endogenous group. The difference of 0.31 of a grade between groups was not statistically significant.

Comparison on Pattern of Reading Errors

To compare the qualitative differences in the reading process, all reading errors for each subject were analyzed utilizing the Monroe method on the following three tests: Gray Oral Reading Paragraphs Test; Iota Word Recognition Test; and Monroe Word-Discrimination Test. Each error was classified as one of the following error-types:

1. faulty vowels,
2. faulty consonants,
3. reversals,
4. addition of sounds,
5. omission of sounds,
6. substitution of words,
7. repetition of words,
8. addition of words,
9. omission of words,
10. refusals and words aided.

After each error-type had been found for all the subjects, the two corrections suggested by Monroe (48) were applied. The first correction consisted of converting raw scores into proportionate error scores[1] to take into account the varying number of Gray Oral Reading Paragraphs read by each subject. The second changed the proportionate scores of each subject to Z-scores for each error-type based on the average reading grade of the subject. This step was taken to control for differences in average reading ability.

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[1]Monroe describes the proportionate score as the total of each error-type multiplied by a given constant to represent the expected number of errors in 500 words. It is based on the number of errors on words actually read. The standard number of 500 words was chosen as the nearest round number to the actual number of words read by the median child of the control group.

Figure 1 presents a profile of mean deviation scores of the error-types. Inspection of this figure indicates that the exogenous group made more total errors and more of the following specific error-types than did the endogenous group: faulty vowels, faulty consonants, reversals, addition of sounds, omission of sounds, substitution of words, repetition of words, and addition of words. The endogenous group made more of these two error-types: omission of words and refusals and words aided.

Data on the group variances and means with their respective tests of significance are shown in Table 7. An examination of this table reveals that no significant differences were found between the group variances and means on total errors and these seven error-types: faulty vowels, faulty consonants, reversals, omission of sounds, substitution of words, addition of words, and omission of words. Findings on the remaining three error-types are discussed below.

Addition of Sounds

The variance for the exogenous group was 4.14; the endogenous group, 1.93. The obtained F ratio of 2.15 between these two variances was significant at less than the .05 but greater than the .01 level of probability. The t ratio of 1.679, based on a mean score of 1.05 for the exogenous group and 0.27 for the endogenous group, was not significant.

Repetition of Words

The F ratio of 1.42 between the variance of .51 for the exogenous group and .36 for the endogenous group was not significant. Inspection of the mean scores of -1.77 for the exogenous group and -2.58 for the endogenous group reveals that the exogenous group made more repetitions than the endogenous group and that both

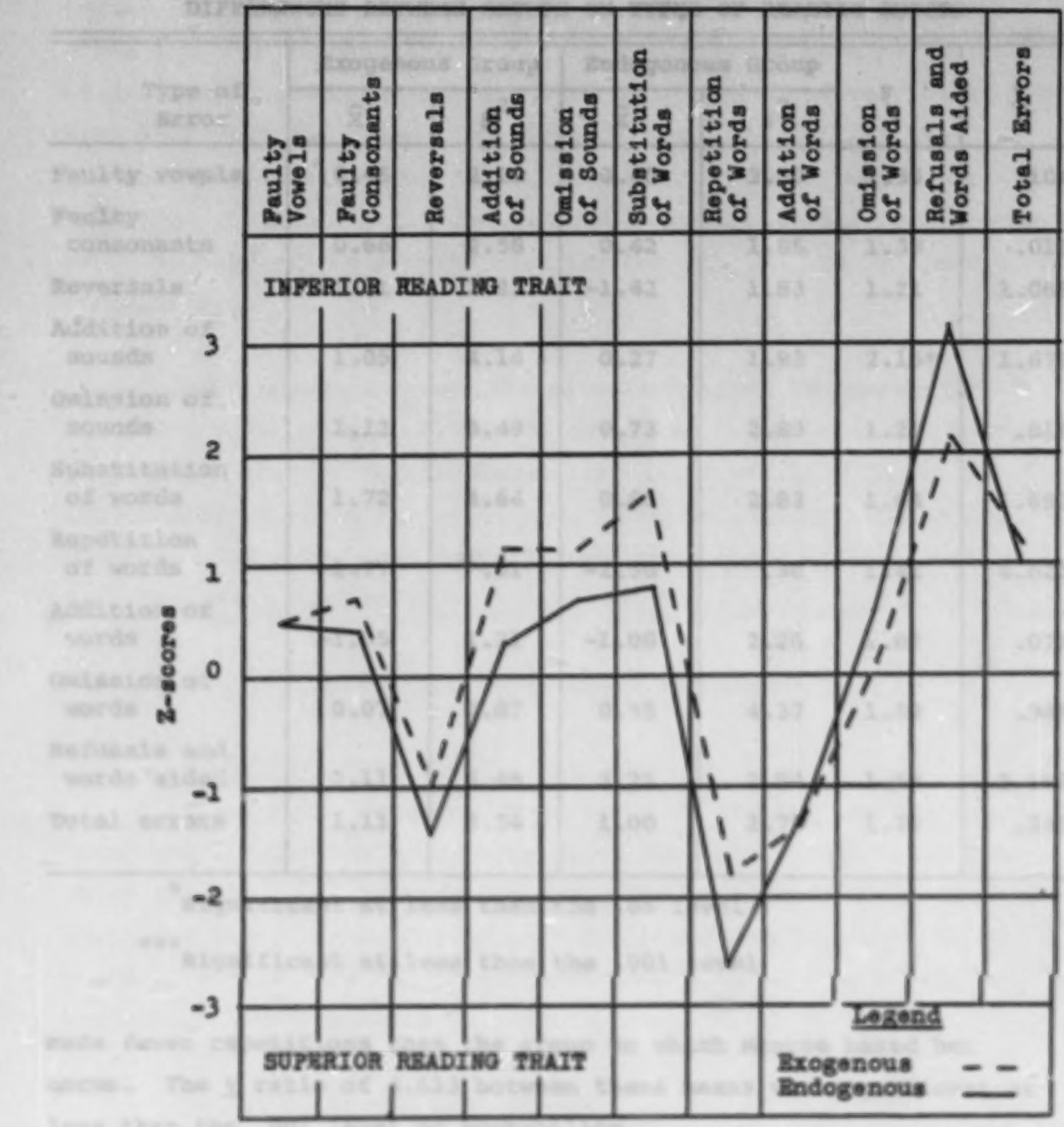

Fig. 1. Profile of mean number of reading errors of the exogenous and endogenous groups on the Monroe Diagnostic Reading Examination.

TABLE 7

DIFFERENCES BETWEEN GROUPS ON TYPES OF READING ERRORS

Type of Error	Exogenous Group		Endogenous Group		F	t
	$\bar{X}$	s^2	$\bar{X}$	s^2		
Faulty vowels	0.45	2.25	0.40	3.03	1.35	.104
Faulty consonants	0.66	2.58	0.42	1.85	1.39	.618
Reversals	-1.01	2.22	-1.42	1.83	1.21	1.068
Addition of sounds	1.05	4.14	0.27	1.93	2.15*	1.679
Omission of sounds	1.12	3.49	0.73	2.89	1.21	.816
Substitution of words	1.72	4.64	0.85	2.83	1.64	1.693
Repetition of words	-1.77	.51	-2.58	.36	1.42	4.623***
Addition of words	-1.05	1.21	-1.08	2.26	1.87	.079
Omission of words	0.07	2.87	0.55	4.37	1.52	.949
Refusals and words aided	2.11	4.49	3.22	2.84	1.58	2.169*
Total errors	1.11	3.54	1.00	2.75	1.29	.235

*Significant at less than the .05 level

***Significant at less than the .001 level

made fewer repetitions than the group on which Monroe based her norms. The t ratio of 4.623 between these means was significant at less than the .001 level of probability.

Refusals and words aided

The variance for the exogenous group was 4.49; the endogenous group, 2.84. The F ratio of 1.58 between these variances had a probability level greater than .05. Examination of the mean

scores indicates that the endogenous had more refusals and words aided than the exogenous and that both groups had more refusals and words aided than Monroe's group upon which the norms were based and also more than any other error-type. It may be recalled that the reverse was found for repetition of words. The mean score for the exogenous group was 2.11; the endogenous group, 3.22. The t ratio of 2.169 between these means fell between the .05 and .01 levels of probability.

With two exceptions, the hypotheses that the population means are equal on error-types failed to be rejected on the bases of t ratios greater than a probability level of .05. These were the differences in means for repetition of words (significant at less than the .001 level) and refusals and words aided (significant at less than the .05 level).

Comparison on Auditory Techniques

Blending Letter Sounds (see Table 8)

The F ratio between the variance of .44 for the exogenous group and .34 for the endogenous group was 1.30. This ratio fell above the .05 level of significance. The mean grade score for the exogenous group was 2.20 grades; for the endogenous group, 2.25 grades. Analysis of the difference between the two means yielded a non-significant t ratio of .295.

Giving Words--Initial Sounds

Variances of .23 for the exogenous group and .2[illegible] for the endogenous group resulted in an F ratio of 1.25 which is associated with a probability value larger than .05. The grade score means for the group were 2.43 grades and 2.42 grades. The t ratio of .080 was not significant.

TABLE 8

DIFFERENCES BETWEEN GROUPS ON AUDITORY TECHNIQUES TESTS

Measure	Blending Letter Sounds		Giving Words--Initial Sounds		Giving Words--Final Sounds	
	Exogenous	Endogenous	Exogenous	Endogenous	Exogenous	Endogenous
N	29	29	29	29	29	29
s^2	.44	.34	.23	.29	.47	.24
F	1.29		1.26		1.96*	
$\bar{X}$	2.20	2.25	2.43	2.42	2.23	1.97
t	.295		.080		1.696	

*Significant at less than the .05 level

Giving Words--Final Sounds

The F ratio of 1.98, based on a variance of .47 for the exogenous group and .24 for the endogenous group, fell between the .05 and the .01 levels of significance. The difference between the exogenous group's mean grade score of 2.23 and 1.97 for the endogenous group yields a t value of 1.696 which is not significant at the .05 level.

Evidence obtained from the analysis of results of three tests of auditory techniques was not sufficient for rejecting the hypothesis that there was no difference between means. Therefore, it was concluded that the observed differences could be attributed to chance.

Comparison on Gates Visual Perception Techniques

Results for both the reading of capital and lower case letters are presented in Tables 9 and 10 and are analyzed in terms of the speed with which they were read and the number of errors made. For speed of reading capital letters the variances were .38 grades for the exogenous group and .46 grades for the endogenous. The F ratio was 1.21 which is associated with a probability level greater than .05. The mean grade scores for speed were 2.46 grades and .149 grades. The t value of .156 was not significant. Analysis of the capital letter errors indicated no statistically significant difference in the variances of the two groups. The t score of .476, based on a mean grade score of 2.20 grades for the exogenous group and 2.23 grades for the endogenous group, has a probability greater than .05.

The variances of the grade scores for speed in reading lower case letters were .51 grades for the exogenous group and .53

TABLE 9

DIFFERENCES BETWEEN GROUPS IN READING CAPITAL LETTERS

Measure	Speed		Errors	
	Exogenous	Endogenous	Exogenous	Endogenous
N	29	29	29	29
s^2	.38	.46	.06	.06
F	1.21		1.00	
$\bar{x}$	2.46	2.49	2.20	2.23
t	.156		.476	

TABLE 10

DIFFERENCES BETWEEN GROUPS IN READING LOWER CASE LETTERS

Measure	Speed		Errors	
	Exogenous	Endogenous	Exogenous	Endogenous
N	29	29	29	29
s^2	.51	.53	.18	.17
F	1.04		1.06	
$\bar{x}$	2.40	2.33	2.29	2.32
t	.357		.277	

grades for the endogenous group. The ratio between these two variances was 1.04 which has a probability value greater than .05. The difference between the mean grade scores of 2.40 for the exogenous group and 2.33 for the endogenous group resulted in a non-significant t ratio of .357. When comparing the number of errors made by the two groups in reading lower case letters, variances of .18 for the exogenous group and .17 for the endogenous group were found. The F ratio was 1.06, which is associated with

a probability value larger than the .05 level. The t ratio of .277, based on the mean of 2.29 for the exogenous group and 2.32 for the endogenous group, fell above the .05 level of significance.

When comparing the two groups on two of the Gates Visual Perception Techniques, there was not sufficient evidence to reject the hypotheses that the population means were equal. Therefore, observed differences were attributed to chance.

Comparison of the Exogenous and Endogenous Groups on the Auditory and Visual Tests

Comparison of the Auditory Acuity of the Exogenous and Endogenous Groups

As a part of the total testing program a pure-tone audiometric examination was administered individually to all subjects. The results are shown in Table 11. By inspection it can be seen

TABLE 11
COMPARISON OF THE AUDITORY ACUITY OF THE EXOGENOUS AND ENDOGENOUS GROUPS

Group	Cases With No Apparent Hearing Loss	Cases With Probable Hearing Loss in One Ear (20 Decibels or More)[a]	Cases With Probable Hearing Loss in Both Ears (20 Decibels or More)[a]
Exogenous	28	1	0
Endogenous	27	2	0

[a]No loss of 25 decibels or more was found

that neither group showed an appreciable number of hearing losses. Only one of the exogenous and two of the endogenous subjects failed to perceive a tone at 20 decibels in one or more of the frequencies tested in one ear. No subject failed to respond to a tone presented at the 25-decibel level in either ear. Since all of the subjects

were able to hear sounds of at least 20 decibels of loudness in one ear and since the instruction in reading was given in small rooms and small groups, it is assumed that any apparent hearing loss had no appreciable effect on reading achievement.

Comparison of the Visual Efficiency of the Exogenous and Endogenous Groups

The Keystone Visual Survey Tests were administered individually to each subject. Inspection of Table 12 reveals little difference between groups on the total and the subtest scores. Chi square tests were computed and the results demonstrated no significant differences between groups. It should be noted that this test was designed as a screening device.

Comparison of Pattern of Reading Errors of the Ten Better Readers in the Exogenous and the Endogenous Groups

Examination of the variances on all the reading grades reveals that the exogenous group was more heterogeneous than the endogenous group. On two of the four tests; the California Achievement Test, and Gray Oral Reading Paragraphs Test, the exogenous attained significantly higher variances. The purpose of this section is to compare the ten better readers of the exogenous group with the ten better endogenous and in the section following, a similar comparison of the ten poorer readers of each group. This analysis attempted to determine the presence or absence of qualitative differences in reading between two groups composed of the ten subjects from each group who obtained the highest average reading grade scores and ten subjects from each who had the lowest average reading grade scores.

TABLE 12

COMPARISON OF THE VISUAL EFFICIENCY OF THE EXOGENOUS AND ENDOGENOUS GROUPS ON THE KEYSTONE VISUAL SURVEY TESTS

	Measure	Exogenous Group		Endogenous Group	
		Satis-factory	Unsatis-factory	Satis-factory	Unsatis-factory
Tests at Far Point	Test 1 (test of stimulus perception)	29	0	27	2
	Test 2 (test of vertical balance)	27	2	29	0
	Test 3 (test of lateral balance)	23	6	28	1
	Test 4 (test of fusion)	22	7	24	5
	Test 5 (test of right eye visual acuity)	23	6	21	8
	Test 6 (test of left eye visual acuity)	13	16	15	14
Tests at Near Point	Test 10 (test of lateral balance)	23	6	26	3
	Test 11 (test of fusion)	24	5	21	8
	Total score	184	48	191	41

Table 13 presents the comparison of the better readers according to average reading achievement and mental age. The exogenous group variance was .55 grades; the endogenous, .19 grades. The resulting F ratio was 2.90, and, as such, was not significant. The mean average reading grade scores were 5.24 for the exogenous group and 4.28 grades for the endogenous. A *t*-test of this

TABLE 13

COMPARISON OF AVERAGE READING GRADES AND MENTAL AGES OF THE TEN BETTER READERS IN THE EXOGENOUS AND ENDOGENOUS GROUPS

Measure	Average Reading Grade		Binet Mental Age[a]	
	Exogenous	Endogenous	Exogenous	Endogenous
N	10	10	10	10
s^2	.55	.19	191.21	166.85
F	2.90		1.15	
$\bar{X}$	5.24	4.28	119.3	110.5
t	3.332**		1.395	
Range	4.02 - 6.45	3.20 - 5.42	103 - 144	90 - 133

**Significant at less than the .01 level

[a]Age in months.

difference resulted in a ratio of 3.332 which is associated with a probability value less than the .01 level.

When a comparison was made of the two groups on Binet Mental Age, the exogenous group variance was 191.21 months; the endogenous, 166.85 months. The F ratio for this comparison was 1.15 and the probability is greater than .05. The mean mental age for the exogenous group was 119.3 months; for the endogenous group, 110.5 months. The t for this comparison was 1.395; the probability level, greater than .05.

Figure 2 gives the profile of reading errors for the ten better readers in the exogenous and the endogenous groups. Examination of this figure indicates that the exogenous group made more total errors and more of the following specific error-types: faulty vowels, reversals, addition of sounds, omission of sounds, and repetition of words. The endogenous group made more of these

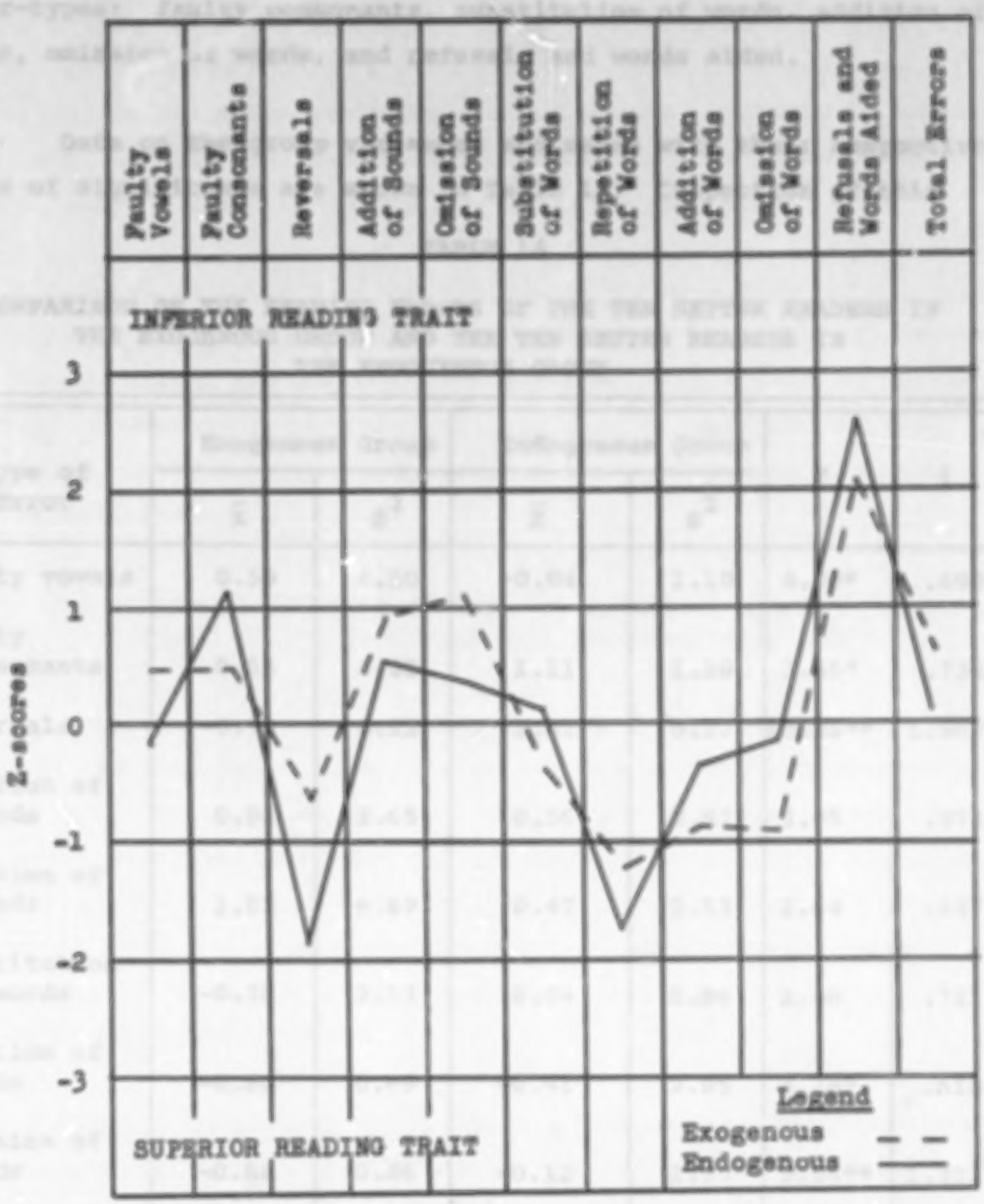

Fig. 2. Profile of mean number of reading errors of the ten better readers in the exogenous group and the ten better readers in the endogenous group on the Monroe Diagnostic Reading Examination.

error-types: faulty consonants, substitution of words, addition of words, omission of words, and refusals and words aided.

Data on the group variances and means with their respective tests of significance are shown in Table 14. Inspection of this

TABLE 14

COMPARISON OF THE READING ERRORS OF THE TEN BETTER READERS IN THE EXOGENOUS GROUP AND THE TEN BETTER READERS IN THE ENDOGENOUS GROUP

Type of Error	Exogenous Group		Endogenous Group		F	t
	$\bar{X}$	s^2	$\bar{X}$	s^2		
Faulty vowels	0.50	4.50	-0.04	1.10	4.09*	.690
Faulty consonants	0.55	4.02	1.11	1.20	3.35*	.734
Reversals	-0.70	4.12	-1.81	0.27	15.26**	1.587[a]
Addition of sounds	0.92	2.65	0.56	0.87	3.05	.573
Omission of sounds	1.01	6.69	0.47	2.53	2.64	.537
Substitution of words	-0.38	2.13	0.04	0.86	2.48	.721
Addition of words	-0.80	0.69	-0.41	2.95	4.28*	.616
Omission of words	-0.88	0.46	-0.12	2.55	5.54**	1.322[a]
Refusals and words aided	2.06	4.57	2.57	1.39	3.29*	1.985
Total errors	0.67	3.36	0.08	0.48	7.00**	1.040[a]

*Significant at less than the .05 level

**Significant at less than the .01 level

[a]Table entered with 9 degrees of freedom.

table reveals that the exogenous group variances were significantly more heterogeneous than the endogenous group at less than the .01 level on the following error-types: reversals, omission of words, and total errors. No significant differences were found between group means on total errors or any of the error-types.

Thus, in comparing the ten better readers from both groups, a statistically significant difference at less than the .01 level was found between the mean average reading grade scores of the two groups. However, there were no significant differences between these two groups on any of the error-types included in the qualitative analyses.

Comparison of Patterns of Reading Errors of the Ten Poorer Readers in the Exogenous and the Endogenous Groups

Table 15 gives a comparison of the ten poorer readers in each of the two groups according to average reading achievement and mental age. Examination of this table shows that the exogenous average reading variance was .10 grades; the endogenous, 106 grades. The F value of 1.67 has a probability of greater than .05. The exogenous obtained a mean average reading grade of 1.69; the endogenous, 1.82. The t ratio for this comparison was 1.038 and, as such, was not significant.

In the comparison of the mental ages of the two subgroups, the variance of the exogenous was 132.96 months; the endogenous, 130.41 months. The F value of 1.02 has a probability of greater than .05. A mean mental age of 103.2 months was obtained for the exogenous; 103.3 months for the endogenous. A t-test of the differences between these means resulted in a ratio of .018 which is associated with a probability value greater than the .05 level.

TABLE 15

COMPARISON OF AVERAGE READING GRADES AND MENTAL AGES OF THE TEN POORER READERS IN THE EXOGENOUS AND ENDOGENOUS GROUPS

Measure	Average Reading Grade		Binet Mental Age[a]	
	Exogenous	Endogenous	Exogenous	Endogenous
N	10	10	10	10
s^2	.10	.06	132.96	130.41
F	1.67		1.02	
$\bar{X}$	1.69	1.82	103.2	103.3
t	1.038		.018	
Range	1.30 - 2.17	1.35 - 2.25	92 - 123	92 - 124

[a]Age in months.

Figure 3 indicates that the exogenous made more of the following error-types: addition of sounds, substitution of words, repetition of words, addition of words, and omission of words. The endogenous made more total errors and more of the following error-types: faulty vowels, faulty consonants, reversals, omission of sounds, and refusals and words aided.

Table 16 shows the comparison of the variances and means for each error-type. There were no between variance ratios with a probability of less than .01. In all of the comparisons of means the probabilities of the obtained t ratios are greater than .05.

When comparing the ten poorer readers of the exogenous group with the ten poorer readers of the endogenous group, no statistically significant differences were found between the mean average reading grades and Binet Mental Ages. An analysis of the pattern of reading errors also showed no statistically significant differences.

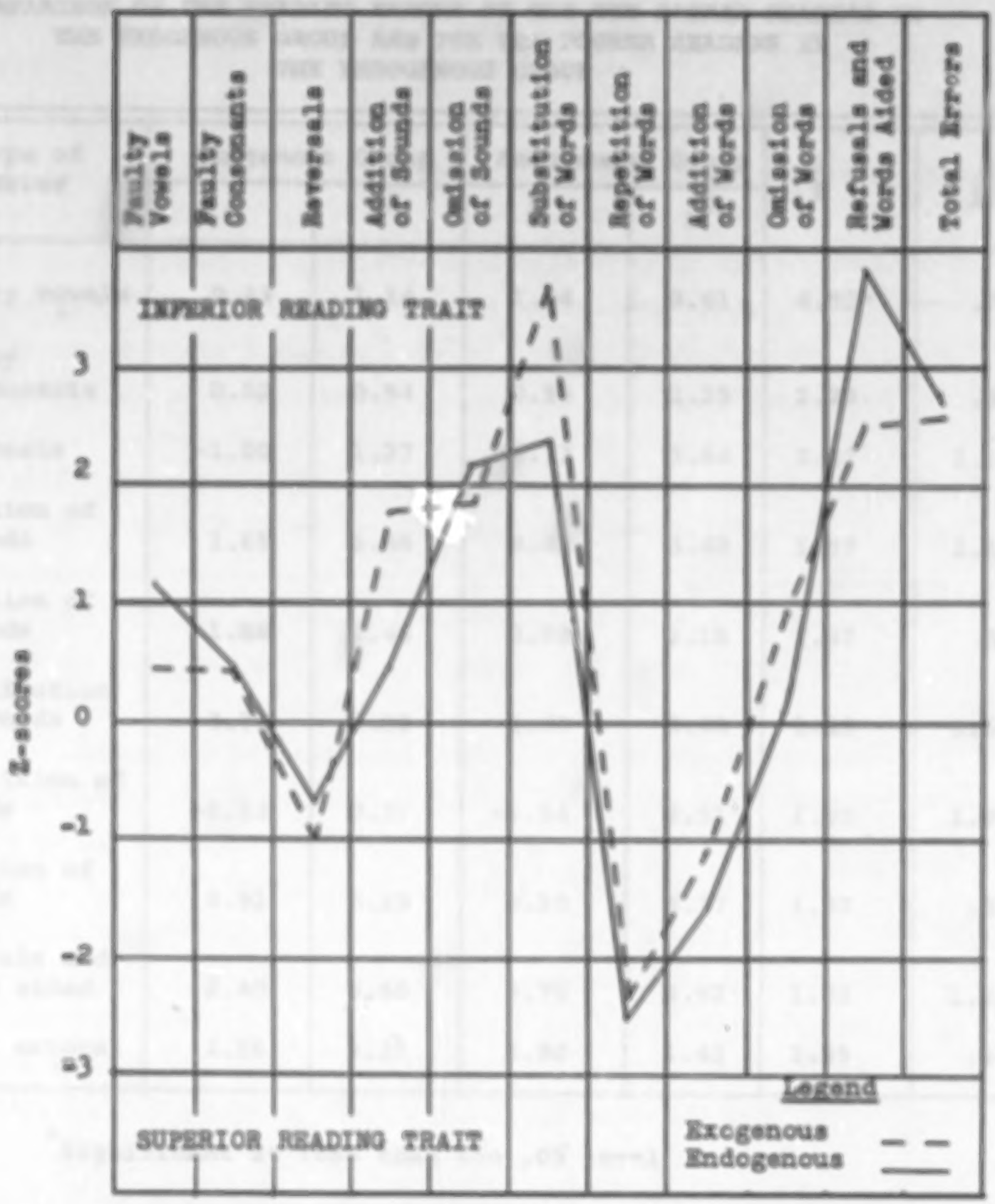

Fig. 3. Profile of mean number of reading errors of the ten poorer readers in the exogenous group and the ten poorer readers in the endogenous group on the Monroe Diagnostic Reading Examination.

TABLE 16

COMPARISON OF THE READING ERRORS OF THE TEN POORER READERS IN THE EXOGENOUS GROUP AND THE TEN POORER READERS IN THE ENDOGENOUS GROUP

Type of Error	Exogenous Group		Endogenous Group		F	t
	$\bar{X}$	s^2	$\bar{X}$	s^2		
Faulty vowels	0.43	1.14	1.04	5.61	4.92*	.710
Faulty consonants	0.52	0.94	0.59	2.25	2.39	.356
Reversals	-1.00	1.27	-0.73	3.64	2.87	1.133
Addition of sounds	1.65	5.46	0.48	3.48	1.57	1.172
Omission of sounds	1.88	1.48	2.08	2.18	1.47	.306
Substitution of words	3.70	2.82	2.30	3.48	1.23	1.669
Repetition of words	-2.33	0.37	-1.54	2.51	1.05	1.906
Omission of words	0.91	5.29	0.10	3.37	1.57	.826
Refusals and word aided	2.40	6.50	3.79	4.92	1.32	1.234
Total errors	2.56	3.22	2.88	1.43	2.25	.443

*Significant at less than the .05 level

CHAPTER IV

DISCUSSION AND CONCLUSIONS

A review of the literature revealed a need for further study comparing the educational achievement of exogenous and endogenous mentally handicapped children. The reported findings of past research indicated no significant differences in the arithmetic achievement of the two groups. The purpose of the present study was to investigate these aspects of the reading process: silent and oral reading achievement, pattern of reading errors, and auditory and visual perception techniques. These were measured by means of the following tests: California Achievement Tests, Gray Oral Reading Paragraphs Test, Iota Word Test, Monroe Word-Discrimination Test, Gates Auditory Techniques Tests (Blending Letter Sounds, Giving Words--Initial Sounds, Giving Words--Final Sounds), Gates Visual Perception Techniques (Reading Capital and Lower Case Letters).

Groups of 29 exogenous mentally handicapped subjects and 29 endogenous mentally handicapped subjects were matched on the basis of mental ages which were within the limits of 7 through 12 years inclusive; intelligence quotients which were within the limits of 50 through 85; and chronological ages which were not more than 22 years. The diagnosis of exogeny or endogeny for each case was established by means of the Riggs and Rain classification system and by the number of background responses made by the subject on the Syracuse Visual Figure-Background Test.

Five hypotheses were proposed about the quantitative and qualitative performance on the reading tests by the exogenous and endogenous mentally handicapped subjects. These hypotheses

were supported by the results of this investigation with the exception of the one pertaining to the pattern of reading errors. This hypothesis was only partially supported since the groups differed significantly on two of the ten error-types. A discussion of each hypothesis is presented below.

H_1: Exogenous mentally handicapped subjects do not differ significantly from endogenous mentally handicapped subjects in silent reading achievement.

The findings of the present study show no significant differences between the exogenous and endogenous groups on the two measures of silent reading achievement. The range of grade scores for the exogenous group on the reading section of the California Achievement Tests extended one grade beyond the highest grade level of the endogenous group. On the Monroe Word-Discrimination Test, which has a more restricted range, both groups scored over the total number of reading grades. The subjects in the exogenous group obtained higher mean silent reading grade scores on both tests. However, the differences in the means were too small to produce a statistically valid level of significance. Therefore, hypothesis 1 is supported. It seems justifiable to conclude that exogenous and endogenous mentally handicapped subjects with comparable chronological ages, mental ages, and intelligence quotients do not differ significantly in mean performance in silent reading achievement as it is reflected by the measures employed in this investigation.

H_2: Exogenous mentally handicapped subjects do not differ significantly from endogenous mentally handicapped subjects in oral reading achievement.

The results on the two measures of oral reading achievement show no significant differences between the two groups. On the Gray Oral Reading Paragraphs Test the range of the grade scores of the exogenous group extended 2.6 grades beyond that of the endogenous group. There was no difference between the lowest and highest grade scores of the two groups on the more restricted range of the Iota Word Recognition Test. The mean reading grade scores on both tests were slightly higher for the exogenous group than for endogenous group. Again, the differences in means were not sufficient to produce a valid level of significance. Therefore, these results lend support to hypothesis 2. It appears safe to conclude that exogenous and endogenous mentally handicapped subjects with comparable chronological ages, mental ages, and intelligence quotients do not differ significantly in mean performance in oral reading achievement as it is reflected by the tests employed in this investigation.

H_3: Exogenous mentally handicapped subjects do not differ significantly from endogenous mentally handicapped subjects on pattern of reading errors.

The qualitative aspects of the reading process investigated in this study consisted of the ten error-types listed by Monroe. It will be recalled that there were no significant differences between the two groups on the mean number of faulty vowels, faulty consonants, reversals, addition of sounds, omission of sounds, substitution of words, addition of words, omission of words, and total errors. There were two error-types, repetition of words and refusals and words aided, in which the means of the groups differed significantly. Therefore, the hypothesis that the pattern of reading errors of the exogenous group does not differ

significantly from the endogenous group is only partially supported.

The exogenous group had significantly more repetition of words than did the endogenous group although both groups made fewer of this error-type than did the group on which the norms were established. According to Monroe, one possible explanation for repetition of words is that the subject reread part of the passage when other errors interrupted the meaning. The reason that both groups made relatively few repetitions may be that the subjects were more interested in word mastery than in meaning and consequently became word-by-word readers. In the earlier mentioned study by Dunn, where no differentiation was made between exogenous and endogenous subjects, the mentally retarded group obtained a mean number of repetitions which falls between the means of the two groups in the present study.

The exogenous group made significantly fewer refusals and words aided than did the endogenous group. Both groups obtained larger mean numbers of this error-type than any other. Here again the results are consistent with those of Dunn. A possible explanation for the large number of this type of error is that both groups of subjects may not have tried to attack the words or did not have the skills to do so. The significantly fewer errors for the exogenous group may be a reflection of this group's higher mean grade scores on the three tests used in obtaining the pattern of reading errors. These results in addition to a significantly greater number of repetition of words indicate that the exogenous group performed closer to the norm than did the endogenous group in terms of reading errors. These results are consistent with the findings of Capobianco in his study of arithmetic.

Since the two groups differed significantly on two of the ten types of errors studied, no generalized conclusion is possible. Further research in which these error-types are considered must be conducted before any final generalization can be made.

A further analysis of the pattern of reading errors was made between the ten better readers in each of the two groups and between the ten poorer readers in each of the two groups. Since this was not a part of the original study and since the number in each group was small, the results of this analysis were expected to indicate trends and direction for further study rather than definitive results. Ever though there was a significant difference between the average reading achievement of the two groups of better readers (exogenous group higher), there were no significant differences between the mean number of total errors or any of the error-types. Further research is suggested before any generalization can be made about these results.

H_4: Exogenous mentally handicapped subjects do not differ significantly from endogenous mentally handicapped subjects in auditory techniques.

The results of the three tests involving auditory techniques indicate no significant differences between the exogenous and endogenous groups. The mean grade scores of the two groups were very similar on blending of letter sounds and giving words with identical initial sounds. On giving words with the same ending the mean grade score for the exogenous group was significantly higher than that of the endogenous group at the .10 level. However, none of the differences reached the .05 level of significance. Therefore, hypothesis 4 cannot be rejected. It seems justifiable to

conclude that exogenous and endogenous mentally handicapped subjects with comparable chronological ages, mental ages, and intelligence quotients do not differ significantly in terms of mean performance in auditory techniques as reflected by the measures employed in this investigation.

H_5: Exogenous mentally handicapped subjects do not differ significantly from endogenous mentally handicapped subjects in visual perception techniques.

The two measures of visual perception techniques consisted of reading capital and lower case letters. The results were reported in terms of the speed with which the letters were read and the number of errors made. The differences between the grade scores of the groups were not statistically significant for the speed or the number of errors in reading the capital and lower case letters. The differences between the means, when they were compared, were all less than one-tenth of a school grade. The probabilities associated with the obtained t ratios were so much greater than the required .05 level that the differences cannot be regarded as even directional. Therefore, hypothesis 5 is supported. There is no basis in these data for concluding that the mean performance of the exogenous and endogenous mentally handicapped subjects with comparable chronological ages, mental ages, and intelligence quotients differs significantly in visual perception techniques as reflected by the tests employed in the present investigation.

The results of the present investigation are consistent with those of previous studies found in the literature which dealt specifically with achievement in the basic academic skills. Bensberg found no differences between exogenous and endogenous

subjects in reading and arithmetic achievement as measured by the American School Achievement Test. Capobianco found no quantitative or qualitative differences between the groups on a battery of four arithmetic tests. Both of these studies employed subjects roughly comparable in chronological age to those of the present investigation.

The findings concerning the exogenous group in the present study are in general agreement with the clinical description of reading difficulties ascribed to this group by Strauss and Lehtinen as noted below:

> Reading disability is characterized by absence of an adequate approach to new words and faulty recognition of familiar words, confusions of similar words and letters, omissions of words, phrases, and sentences with a generally careless attitude toward the content of the material read (58, pp. 169-170).

But, the same general description could be applied to the endogenous group in this study. The relative absence of significant differences between the two groups in this investigation indicates that their reading achievement and, for the most part, their pattern of reading errors were similar. The major difference between the two groups is the amount of heterogeneity within groups; the exogenous subjects' range of performance was consistently broader than the endogenous range.

Strauss and Lehtinen describe procedures and special techniques of reading instruction for brain-injured children. They state that their approach is designed to counteract the organic disturbances of behavior such as distractibility, hyperactivity, and disinhibition.

As far as can be determined, the methods used in teaching reading to the subjects involved in this study did not stress the

specific aids described by Strauss and Lehtinen. [The fact that comparisons between the exogenous and endogenous groups on the quantitative and most of the qualitative aspects of test performance did not appear statistically significant tends to indicate that the degree of general disturbances of behavior of the exogenous group is not sufficient at this time to interfere with the acquisition of reading skills over and above the difficulties encountered by the endogenous group.] Perhaps the more meaningful question to ask would be: How many separate populations are included in the broad category of brain injury: After establishing these: How do we best handle each of these sub-categories, psychologically and educationally?

These conclusions are restricted to populations characteristic of the present sample and to the aspects of reading achievement assessed by the techniques employed. Broader interpretation must await subsequent studies utilizing more extensive populations and measures of reading achievement. Of particular interest would be the evaluation of the reading process of younger groups and groups which attend special classes in the public schools. Also important for further investigation is research pertaining to personality and behavioral characteristics of exogenous children and their effect on the learning processes and achievement in the various academic areas. Upon the completion of such studies, the advisability for modifying the special education program for all or certain of the exogenous mentally handicapped group might better be determined.

Currently, an investigation under the same project director is nearing completion which seeks to identify and isolate a few of the sub-populations of brain injury. Results of this new categorization should further clarify the discussion and conclusions regarding educational and psychological variations in brain injured and non-brain injured, mentally retarded subjects.

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